ANÆSTHETIC TECHNIQUE FOR OPERATIONS ON THE NOSE AND THROAT

A. DE PRENDERVILLE


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OPERATIONS ON THE NOSE AND THROAT.

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ANÆSTHETIC DIFFICULTIES AND HOW TO COMBAT THEM.

H. J. GLAISHER, 57, WIGMORE ST., CAVENDISH SQUARE, W.

THE ANÆSTHETIC TECHNIQUE FOR OPERATIONS ON THE NOSE AND THROAT.

BASED ON LECTURES
DELIVERED DURING THE SESSION 1905-6 AT THE NORTH-EAST
LONDON POST-GRADUATE COLLEGE.

BY

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London:
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1906.

PREFACE.

IN preparing this little book for publication, I have been actuated by the sole desire to offer practical suggestions, in a branch of operative work which has grown greatly in our time. My own experience at the London Throat Hospital during the last eight years has taught me many things, and chiefly, the need for precise technique in dealing with the Anæsthesia of the Nose and Throat.

The evolution of Rhinological Surgery during the last decade has been very marked, and the growing tentency to adopt the Upright Posture in operations on the Upper Air passages, has resulted in the need of much precision and added detail on the part of the anæsthetist. In the following pages, I have endeavoured to indicate and emphasise the special points which demand notice.

Anæsthesia, even in its simplest forms, requires care and attention on the part of the administrator. But

knowledge too is needed, and this alone comes from training. From start to finish the anæsthetist must be on guard — keenly observant, clear-headed and alert, ready of resource, ever watchful.

I am greatly indebted to the various Instrument Makers and others, whose names appear in the text, for the loan of wood-blocks and electros.

A. DE PRENDERVILLE.

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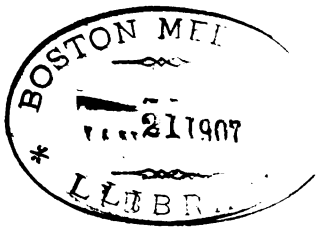
PORTLAND PLACE, W.

LIST OF ILLUSTRATIONS.



Anæsthesia for the Nose and Throat.

General Considerations.

REGIONAL surgery, the natural outcome of increased pathological knowledge and a finer and more improved technique, has made such strides during the last twenty years that nowadays, no organ can be said to be quite free from the risk of attack; and if the zest of conquest sometimes leads men into strange and devious paths, it can at least with justice be affirmed, that on the whole mankind has gained by this vast and brilliant activity. Out of the chaos of the past we have evolved the order of the present, and perchance the future holds but few mysteries yet to be solved. Be this as it may, the surgery of our time has achieved glories which must seem to thoughtful men, not merely the realisation almost of the ideal, but even in some aspects the evolution of the miraculous.

It has been said, and said truly, that Opium is the gift of God to man; and if this be true of Opium, how much more true is it that Anæsthesia is a greater gift still? Without it, all of progress that has marked the path of surgery during

the last seventy years, would have been unrecorded; Conservatism and the wondrous measures of relief that spring from it, would still have been as far removed from us as are the Greek kalends, and now instead of basking in the sunshine of Hope, we should be still struggling in the meshes of Despair.

Of old, when suffering long drawn out, cried aloud for some nepenthe to soothe the gnawing pangs of insatiable disease, it was the surgeon's knife and opium that brought for a space, surcease from pain and anguish. To-day it is the surgeon's knife again and anæsthesia—the deep unconscious state that helps the skilled hand to conquer and to save. Slow to act in the past, the modern surgeon armed at all points, boldly explores the very secrets of the brain and stops not at the confines of the heart. Anæsthesia then and surgery go hand in hand together—a noble partnership for all well doing.

There is no special portion of the body in which operative work has made more solid advance, than in the region of the throat and nose. In recent years the anatomy of these structures has received precise and accurate attention, with the result that there has arisen a school of craftsmen second to none in manipulative skill, whose labours, based on sound conservative principles, have brought about a revolution of methods and of treatment, undreamt of by an earlier generation. Specialism in its highest sense was needed for this task, and as it behoved the surgeon to train himself rigorously on set lines, so, too, it came about that the anæsthetist had, in a large measure, to follow his example. Without doubt, much of success depends upon a recognition of these facts, and it will, I think, be freely admitted that the more

perfect the co-relation between skilled principals, the better will be the ends achieved. So much so is this the case, in dealing with manipulative measures about the throat and nasal cavities, that, from the anæsthetic point of view, there seems some probability that in the near future, men will devote themselves more and more to limited specialism in this connexion.

To what extent a departure of this kind should be approved of, it is difficult to say at present; nasal surgery, with its minute and intricate details, demands much now from the anæsthetist, and as time grows, it will demand more. With every desire to be catholic in the application of his art, an administrator may find his path marked out for him by the exigencies of his practice, and hence will fate compel his footsteps in one direction. This at least is certain. However well versed a man may be in general anæsthetic procedures, careful training of special character is needed for the complete fulfilment of his task in nasal work, and as there is a growing tendency to employ chloroform largely in this class of case, it will be readily seen that the situation is one that may well tax the nerve and skill of the anæsthetist to the utmost.

When we consider the enormous amount of work that is now done, both in special hospitals and in private, and the general freedom from disaster following surgical interference, we have, indeed, fair reason to speak with pride and satisfaction of the admirable share of anæsthesia in such fortunate results. And it is not alone the immunity from grave issues that should claim our attention. We aim at so directing our attack, as to maintain an anæsthetic sequence robbed not only of danger, but also of difficulty and discom-

fort, to operator and administrator alike. The attainment of these ends is not always easy; at times it is indeed impossible; but whether the way be smooth or rough, we aim always at methods of perfection, and not unfrequently reap a full measure of success. Alarming crises occur often from a disregard of obvious preventive measures, or a lack of knowledge of the peculiar and unique conditions associated with certain anæsthetic states. A teacher may and can, of course, point out the pitfalls, but practice alone will teach a man to correct his errors, and improve his technique generally.

Selection of Cases.

By far the largest number of patients that will require anæsthetic attention at our hands, will consist of **children** and **young adults** varying in age from six months or a year to nineteen or twenty. In **childhood,** as we know, large tonsils and adenoidal growths abound, and must be dealt with. At a later age, recurrences of these same disorders, or gross remnants of previous growths will need removal. We meet with all degrees of obstruction, from more or less complete blockage of the naso-pharynx and partial occlusion of the eustachian tubes, to simple central overgrowth of Luschka's tonsil in the vault of the pharynx. The former condition compels absolute mouth breathing, and presents to view the **typical adenoid expression** with which we are all familiar. The anterior and mid-nasal cavities, are ill developed and collapsed from disuse, and physical and mental development is, as a consequence, much impaired or arrested. Breathing exercises and other aids to healthy life and vigour

have been suggested and carried out, with a view to obviate the need of active remedial measures; but though much may be done in these directions, the treatment generally adopted is complete removal under anæsthesia, if possible at one sitting. In **adults** the range of ailments is much greater. Simple polypi, chronic hypertrophic enlargements of the turbinates, spurs, rarefying osteitis of the ethmoids, empyema of the antrum of Highmore, septal deflections and caries of the nasal bones—these and other subordinate conditions constantly present themselves for treatment.

Now, whereas in children, simple measures will usually suffice and prolonged narcosis is generally uncalled for, in many of the maladies just enumerated, we must arrange for a lengthened period and degree of unconsciousness, and must, moreover, be prepared to deal with difficulties which do not obtain in shorter cases. There is in addition this to be said for **chronic cases**—they are often, from the very nature of things, the victims of **toxæmia,** and, as such, are usually not physically at high water mark. Old muco-purulent conditions of the nasal fossæ, associated with **ethmoid disease** or polypoid thickening of the nasal mucosa, leading to hypersecretion and catarrh, bring about inevitably, if unchecked, an altered state of health, which must be allowed for in conducting an anæsthetic sequence.

Again, **hæmorrhage** is sometimes severe, especially when large portions of bone are detached *en masse*, and so, we have to guard against shock from blood loss—an important factor in patients already lowered in body tone, by long continued disease. Bleeding, *per se*, is not in great degree an element of much concern in the surgery of the throat and upper air passages; it may, and often does, give rise to

trouble **purely mechanically,** and it is precisely from that direction that we have to deal with sudden crises. Occasionally the removal of a moriform body—the posterior end of the inferior turbinate—will be followed by brisk hæmorrhage, or the stump of a tonsil freshly guillotined will bleed freely, but these, on the whole, are rare accidents, and, except in the case of hæmophilics, still more rarely resist prompt treatment.

Clearly, therefore, we may broadly describe the anæsthesia of children as simple, and the anæsthesia of adults as in a greater degree complex and not unfrequently difficult. The conditions in the two groups are widely different, and, obviously, the fixed habits and indulgences of a later life, must induce changes, both physical and functional, which are necessarily absent in virgin soil. It would be idle, however, to assume that childhood and early adolescence, should be grouped in one class—this indeed would be very wide of the mark. From the anæsthetic standpoint, there are **types in children** as in the full grown; they must be recognised and allowed for. The *gamin* of the pavement, neglected and ill-fed, differs as much from the sturdy schoolboy, nourished on

> . . . . the brisk and buoyant air
> Of some delightful upland –

as the sorry nag of commerce differs from the blood-horse. The model is the same in both—how changed for each the aftergrowth! **Heredity** will brand one child a puny weakling, and give to the other every favour of the Gods!

These, then, are general points which experience has taught us to observe in regard to classification. From these data we must make our own deductions and formulate rules of conduct.

Preparation of Patients.

In a future section, due notice will be taken of general preparations before operation. Here, I will confine my remarks to details that specially apply to the nose and throat. And first, as to the **cleansing of the cavities to be attacked.** In young children, adenoidal growths and large tonsils, much as they obstruct the airway, do not as a rule give rise to local decomposition of secretions and evils resultant therefrom. The anterior nares are usually, it is true, in a state of sub-chronic catarrh, but the process has not had time to ripen into anything more dangerous. Probably, therefore, the ordinary practice of proceeding at once to operation, *i.e.*, to a removal of the cause, is the soundest treatment that can be adopted. Thorough clearance of the naso-pharynx and the choanæ, will re-establish perfect freedom of nasal respiration, and probably obviate the need of any further interference at all. In children who have attained to the age of puberty, it will be well to insist upon preliminary alkaline **douching** of the nose, for some days beforehand. The presence of thick glairy mucus during an ether sequence is very annoying, and much hampers the administration.

There is **with ether,** a marked **increase of mucus,** and if the patient be in the supine posture, nasal secretions naturally gravitate to the back of the throat, and materially complicate matters. It is difficult to make parents see things in our light, and still more difficult to make them carry out our orders; moreover, this is a question in which the anæsthetist has no voice; but those who have knowledge of this branch

of surgery, will, I think, admit that the suggestion of a **preliminary nasal toilet** is not altogether a counsel of perfection, and would, if adopted as a routine measure, result in much benefit all round.

To children of an older growth, lavage of the nostrils, after simple demonstration, would come as a manœuvre of no difficulty. The one objection, so far as hospital practice is concerned is, that patients of this class come straight from home to the operating-table, or at most spend but one night in the wards beforehand, and hence offer no chance for trained supervision and attention. Another point which I think well merits a much closer study than it has hitherto received is the **preliminary cleansing of the mouth and teeth** —the buccal cavity as a whole. Microbes abound in the mouth, some of them benign enough and sentinels indeed on guard, but others ready to rise in revolt at any moment. Cleanliness of mouth and teeth, is not regarded by some people as a necessary adjunct to the toilet, and, as we all know, it is almost universally ignored by the poor. Foul mouths and rotten teeth contain potentialities for evil, which are simply appalling, and yet we rarely protest against this abounding condition of sepsis. It cannot be gainsaid, that just as we prepare other regions of the body with minute care for operation, so too ought we to purify at least in some sense, structures round about, in operations on the throat and nose.

Post-operative lung mischief is often ascribed to the baneful effect of Anæsthesia, more especially when Ether is the narcotic used, and though I would not affirm that pneumonia and bronchitis do not sometimes arise from prolonged and deep etherisation, I am distinctly of opinion, that sepsis of

the mouth is much oftener the prime cause of later organic infection. I have no doubt but that a dental overhaul and general clean up, as a prelude in these cases, would lead to good, and save anæsthesia from much unmerited discredit.

As to **local sanitation** in adults, and especially in those about to undergo extensive nasal operations, it is highly probable that they will have been submitted to a long course of douching already. Should this precaution, however, have been neglected, the omission should be rectified without delay. Muco-pus in abundance complicates the induction of narcosis, and its presence, for other reasons which will be considered later, should be dispensed with.

It is in this class of case—**Chronic nasal disease**—that we see the evidences of long continued **mild toxæmia.** Physical powers are often much impaired, and functional derangements are common, so much so, that gastric and bowel trouble will often leave a profound impression on the general health. Under these circumstances, it is usual to find everywhere signs of malnutrition and bloodlessness. Carious teeth and pale spongy gums tell their own tale. Symptoms are always, of course, much exaggerated where persistent neglect of the teeth has been superadded to the nasal ailment. Again this is the rule with a very large class, and though, as we have seen, a grosser sepsis is warded off by local measures nasally, nothing or nearly nothing is ever done for the septic buccal cavity. The mere fact of swallowing microbe-laden saliva, during a long operation, is quite sufficient to account for intractable vomiting after anæsthesia, and may well be the cause of later constitutional disturbance. When opportunity offers, I suggest the use of a **mouth wash** either of Lysoform or Glyco-Thymoline, as a preliminary to nar-

cosis in cases of untouched dental decay. Flushing out the mouth two or three times on the morning of operation, I have found excellent in practice and a distinct deterrent to vomiting in suspicious cases.

Methods that obtain in general surgery as preludes to operation, hold good in nasal and throat work, except perhaps, when Gas is used alone in tonsillotomy or adenoid enucleation. N_2O rarely causes sickness under any circumstances. Children come better to the table fasting; the lungs have free play and there is no danger of heart failure from the pressure of a stomach largely distended.

In regard to alcohol in special cases, I think that brandy one hour before operation is often most valuable; it is readily absorbed and helps to nerve a patient for the ordeal. The practice of giving beef-tea three or four hours beforehand, a custom more honoured in the observance than in the breach, in some quarters, has nothing to commend it. Beef-tea, to a patient whose functional activity as far as assimilation is concerned, is temporarily inhibited, is not an ideal nutriment. Chicken-jelly and beef-jelly of approved make, may be permitted, but only when there are special indications for its use.* *Cæteris paribus*, the emptier the stomach, the easier and better the narcosis. This is so well known now, that it has become one of our first axioms—a golden rule of Anæsthesia.

Speaking generally, it is most unusual in throat or nasal work to have any need of preliminary stimulation; and from the anæsthetist's standpoint, it is of course undesirable.

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* Robust subjects will do well without anything on the morning of operation. For operation in the afternoon a light meal of bread and milk or tea and toast should be taken about 10 a.m.

Anything which will delay full narcosis, must mean additional trouble to him. It must be remembered that after the first beginnings, pulse and breathing improve under most narcotics in operations of moderate length; hence the necessity of great restraint in the matter of stimulants. They may readily do too much for us.

Primary Narcotics, Combinations and Sequences generally used in Nose and Throat Operations.

Primary Narcotics comprise:—

NITROUS OXIDE GAS.
ETHER.
CHLOROFORM.
ETHYL CHLORIDE.

Combinations are:

ALCOHOL, CHLOROFORM AND ETHER.
CHLOROFORM AND ETHER.
GAS AND ETHER.
GAS AND OXYGEN.
ETHYL-CHLORIDE AND ETHER.

Sequences are:

NITROUS OXIDE GAS-ETHER-CHLOROFORM.
ETHYL CHLORIDE-ETHER-CHLOROFORM.
C.E. or A.C.E.-CHLOROFORM.

or a rearrangement of these various Anæsthetics to suit the exigencies of the case, or the wishes of the administrator. **Familiarity** with certain sequences and combinations will naturally predetermine selection. It is important, to this end, to work out on certain fixed lines one's own experience,

and thus to have complete grasp of detail and a method or methods which have been well and thoroughly tested.

Whether we regard anæsthetic procedures in these regions from the point of view of the operator, or the point of view of the anæsthetist, there is this common ground to stand on, the narcosis aimed at **should be as free as can be from danger** and from **local congestion.** How this happy state is to be reached, will depend largely, if not indeed entirely, on the knowledge and experience of the anæsthetist. The capacity for taking infinite observations, and applying knowledge gained by constant practice—more especially the wise habit of checking one's own work by careful and regular criticism—these are factors of surpassing moment in the making of competent administrators. The pity is that so many learners decline to adopt routine at all, and hence they have no platform, and all is chance. Slavish adherence to fixed rules can never receive scientific support, but the tyro must learn, just as the teacher must dogmatise. Later when he feels his strength, let each man work out his own salvation. My plaint is, that even now, in spite of academic training so called, practical anæsthesia, even in its simplest forms, is a closed book to the vast majority of budding practitioners.

I will not attempt a description of every sequence enumerated above. These things are all set out in full in text books—notably in Hewitt's classic work—but I will, as far as possible in future pages, deal with some methods of universal acceptance.

Sterilisation of Apparatus.

This is a very important matter and deserves special attention. Not only should the plated parts be **boiled before operation,** but masks and rubber face pads, should be well washed with soap and water, and then immersed in antiseptic solutions before being used. Gags and props will also require the same treatment, but as this is always done in hospitals by theatre attendants, it will not come within the immediate purview of the anæsthetist. In private, however, he does everything himself. Gas and ether bags must be rinsed out and hung up to dry after use. In ordinary non-infective cases Lot. Acid. Carbol. 1 in 40 will do excellently well, care being taken to wash out finally with sterilised water. A suspicion of Tubercle bacillus, or other specific conditions, will need stronger measures—Lot. Hydrarg. Biniod. 1 in 1,000 will prove very valuable in this case. The solution can be readily prepared from the Soloid Mercuric Potas. Iod. and diluted at will, by the addition of more or less water as the case may be.

As to the cleansing of celluloid face masks and rubber pads, nothing can be better for this purpose than Izal soft soap. It is a very powerful disinfectant, and lathers well. It can be thoroughly rubbed in with a hard nail-brush, reserved for this use alone.* Hewitt's stop-cock is difficult to clean well; it cannot be boiled on account of the enclosed rubber valves. I have found it easy to brush out the whole fixture with a strong solution of Phenol or Lysoform, applied

* Lysoform in 3% solution is also admirable for this purpose.

on a large camel-hair brush, mopping up superfluous moisture with a second brush. Obviously, **perfect asepsis** can only be secured by close attention to many details, and it is easy in the hurry and rush of work to overlook many things, especially those that demand close personal care. The armamentarium of an anæsthetist can always be kept ready for use by enclosing the different parts—gags, mouth props, stop-cocks, etc., etc., in one large batiste bag. For face-pieces and rubber pads a separate small bag should be used. The advantage of batiste is, that it will stand any amount of boiling, without deterioration. Gas and Ether bags after drying, should have their mouths covered with small squares of batiste, kept in place by tape or elastic bands. By the adoption of this **general method,** perfect surgical cleanliness can be secured, for all apparatus liable to be brought in contact with the patient. The plan of sterilising instruments and then replacing them in loops or pockets of an ordinary surgical bag, is after all a useless proceeding, and may conceivably be dangerous, by giving a sense of false security. Far better is it to cleanse everything with care and stow away in sterile containers, ready for any emergency that may occur.

With these general and special considerations held in mind, we may proceed to an analysis of the subject—**Posture or Decubitus** as applied to operations on the Nose and Throat.

CHAPTER II.

Operations in the Supine Posture.

Posture for the conditions under review, may be considered under two headings, the **Dorsal** or **Supine,** and the **Upright.** These again are modified at the will of individual operators. Thus we may have the Dorsal decubitus with **head flat,** *i.e.*, in the same plane as the trunk, or with **head extended** over the edge of the couch. The **upright position** may be strictly rectangular or sloping to an angle of 45%. Again, with trunk and limbs lying flat, the body is rolled over almost into the **semi-prone** posture by some operators in tonsillotomy. Fine gradations of both the Dorsal and Upright positions, are met with constantly in practice. What chiefly concerns us is the *relative value* of each, the advantage (if any) of the one over the other, the special anæsthetic needs of both, and finally an appreciation of the various factors to be considered, in arriving at a decision for or against the one or the other. The anæsthetist is not always consulted as to posture, but clearly he should have a full knowledge of every difficulty bearing on the subject, and be prepared to offer practical suggestions if called upon to do so.

The **Dorsal or Supine Posture** regarded by one school as ideal for all operative measures on the throat and nose, is anathema to another. Nevertheless, the dorsal posture has been adopted for many years by the great majority of prac-

titioners, and for reasons both of safety and convenience, it has strong claims which cannot easily be overlooked. We are concerned here, however, not so much with a discussion of its merits or demerits, but with its anæsthetic possibilities, and the demands likely to be made on us as administrators. The position simply put is this. The Surgeon desires the dorsal posture for an adenoidal operation, for tonsillotomy, for removal of posterior ends of the inferior turbinates, or for a score of other intranasal or buccal conditions, which need not be specifically stated. He desires that the head should be flat on the table or slightly raised on a hard pillow. We must, then, decide upon the anæsthetic procedure to be adopted. Cordial co-operation and a knowledge of each other's methods, will smooth away all difficulties of selection. For our purpose we will assume that a central clump needs removal from the pharyngeal vault. This, in the hands of many experts is a very simple matter, and can be accomplished in a few seconds, by the dexterous use of Gottstein's knife and forceps, or by the former weapon alone. We must arrange for an available anæsthetic period of 40 seconds. To this end we choose Nitrous Oxide Gas.

Preliminaries.—Everything must be in readiness before we begin—instruments, sponges, tongue forceps, gags, etc., and—always in reserve—a tracheotomy case. If ordinary garments are worn they must be loosened everywhere. Macintosh coverings are often tightly tucked in round the neck; the anæsthetist must satisfy himself that they do not impede absolutely free respiration.

A rapid survey of the teeth will indicate the best position for the gag or mouth prop. The gas cylinders must be tried and the key found to work easily. Above all must we see

that the rubber tube connecting the bag and the cylinder, is firmly attached at both ends. The occiput will rest on a sandbag pillow, sufficiently high to give the correct elevation to the head.

Position of the Anæsthetist.— He may stand either at the side of the patient or **behind the head.** In the latter position he has far greater range of movement, and a better command of the situation all round. Moreover, as sole assistant, he is well able from this point, to follow minutely every move of the surgeon, and can render prompt aid in steadying the head, sponging out the throat, and generally lending a hand. This would not be possible, at least with equal facility, from the side.

The **gas cylinders** must be so placed as to be within easy reach of the left foot. Nothing is more annoying than to attempt control of the key from an awkward angle; it leads to inequality of flow, much undue exertion, and possible waste of gas from inability at the psychical moment to shut off the valve.

The anæsthetist should be almost as careful as the operator in arranging **his sanitary toilet.** Hands must be washed and scrubbed, and then soaked for a few seconds in some chosen antiseptic solution. He should discard his coat in an outer chamber, and be covered with an overall or fitted coat. These can be had made either of cotton or macintosh. A very useful pattern, is the one adopted by this hospital. It falls in one piece in front, with half-length arms at the sides, and is tied behind by rows of tapes. Nothing can be simpler nor more effectual. Enough has been said in a previous lecture about the sterilisation of the anæsthetic paraphernalia proper. If, however, there be any doubt as to the

perfect cleanliness of a gag or face-piece, it will be well to re-boil the former at once, and soak the latter again before beginning. I have dwelt at some length and with precision on these many pre-operative details, because this one description will do for all the subsequent varieties of anæsthesia that may be described, to this extent at least, that while we may modify our proceeding we must carry out by routine, as it were, the cardinal points involved. Any disregard of strict sanitation may lead to trouble. To do all these things thoroughly, we must accustom ourselves by practice to do them almost automatically.

N_2O Administration for Adenoids.

The patient being in position, the anæsthetist stands behind the head and places a Doyen's gag, or if preferred, a large metal rubber-covered prop between the teeth. If a Doyen be used, it should be firmly fixed between opposing incisors, **exactly in the middle line.** Care must be taken to

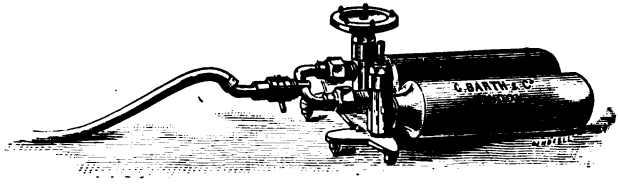

FIG. 1.

GAS CYLINDERS WITH FOOT-KEY AND TUBE.

avoid running the edge of the upper blade into the hard palate. Beginning with a prop *in situ*, we may either place it between the front (the incisors) or side teeth; for adults who can exercise moderate self-restraint this arrangement will often do well, but it is impracticable with children,

who may quickly struggle and would unquestionably displace the prop at once. The disadvantage of the prop is, that it must be supplanted by a gag, the moment the operator begins.

I shall here describe the procedure with Doyen. The gag should be at once fairly widely opened, and the face-piece applied over it. If this latter be of large size, with pneumatic pad well distended, firm pressure **over the handle** will effectually prevent any air admission. It is never necessary to use a cotton wool plug or lint to fill up the gaps.

FIG. 2.

HEWITT'S STOP-COCK.

The gas bag fitted with Hewitt's stop-cock is used two-thirds full. We instruct the patient to breathe deeply and this he does, drawing in air through one valve and expiring through another. After two or three respirations (in strong people the fewer the better), we close the inspiratory valve and let in gas; as the bag empties we

turn on more N_2O in order to keep up a slight overplus. **Firm equal pressure** is all this time being maintained on the face-piece, so as to exclude air altogether. As the anæsthesia deepens, cyanotic symptoms slowly develop and increase, breathing becomes noisy or stertorous and slight jactitation finally marks the physiological limit. We may, if we desire to increase the length and depth of narcosis, close the expiratory valve from time to time during the administration and so allow to and fro breathing. The instant we are satisfied that the patient is ready for operation, we discard the mask and turn our attention to the gag, and the pose of the head. Both hands are practically free, and should be placed flat on either side of the head and face; in this position they act as very firm supports. When the surgeon has completed his work, we rapidly **turn the head well to the side** to facilitate the escape of blood, and have the body rolled round at the same time into the semi-prone posture. Recovery from Nitrous Oxide Gas is usually so quick, that cough reflex is at once re-established, and on this score decubitus is of little or no concern. An operator may desire to enucleate the tonsils also at one sitting. Should this be so, he may elect to allow the Doyen to remain in position, in which case the anæsthetist, still steadying the head, pushes up each tonsil from beneath the jaw angle to facilitate removal, and sponges out the throat if necessary as a finish. The Doyen gag, if objected to, can be easily replaced by an Ackland or Ferguson. It is a good plan to have one for each side, so that as each tonsil is guillotined, the corresponding jaw is quite clear for the operator, traction being made on the opposite side.

One great advantage to be gained by gagging the patient

to begin with is, that thereby there is a saving of some seconds, and every second is of consequence in such hurried proceedings. A point to be remembered in this connection—**open the gag at once as widely as possible.** Otherwise damage to tender teeth may be done at a later stage, by trying to force open jaws held together by spasmodic masseters.

Children under four are not fit subjects for Nitrous Oxide anæsthesia alone—their lungs and ribs are unable to withstand the severe strain put upon them, during the rapid induction of narcosis. The description given above will serve for all cases of ordinary character either in adults or in children. Danger may be said broadly speaking to be non-existent, in so far as the anæsthesia is concerned. There is one pathological state, however, of which we must beware. Acute Tonsillitis and Peritonsillitis, associated as it nearly always is, with considerable inflammatory thickening of the fauces and laryngeal tissues, may cause so much **mechanical obstruction** to the airway, as to give rise even in its normal course to much anxiety and respiratory distress. To give gas in such a case may be to court disaster ; the respiratory difficulty already existing will assuredly be much increased and may end in complete arrest. Any anæsthetic may be a source of danger under such conditions; Nitrous Oxide Gas is unquestionably contra-indicated.

No special description beyond what has been already given is needed for the many minor conditions about the throat, for which gas may be the anæsthetic selected. To recapitulate. The administration proper being ended, it is the duty of the anæsthetist to play the *rôle* of **chief and only assistant**; he must hold the gag in place, fix the head, sponge out the throat, press up the tonsils and generally associate himself

with the work in hand. The whole procedure is so rapidly got over, that a plethora of assistants would simply impede matters and create disorder. From first to last, the anæsthetist has the patient under his sole control, and if he understands his business, the series of events that follow each other in such rapid order, will mark a sequence free from hitch or trouble of any kind. It is quite easy for an expert operator to

FIG. 3.
JUNKER'S CHLOROFORM APPARATUS.
(BUXTON'S MODIFICATION.)

do a great deal under Nitrous Oxide Gas, much more indeed than is generally thought possible with this agent; and this, too, without pushing the narcosis to the utmost limit; and though the combination of N_2O and Oxygen will naturally suggest itself as a substitute for more extensive short operations, still it is well to know that gas alone properly given has much to commend it, and is a most valuable agent in simple throat and nose work.

Gas-Ether-Chloroform Sequence.

This may be described as the classic or routine sequence for the conditions under review, and we may attempt a description of the administration in the Dorsal posture, and endeavour to emphasise certain points in connection therewith.

Age suitability.—Practically age and sex may be ignored in our calculations. Even very young children may take Ether, though gas *per se* cannot be allowed below a certain age. True, one would suggest C.E. or Chloroform for children of very tender years, but if the other sequence is asked for, we ought to know that, *cæteris paribus*, it is allowable to healthy children not younger than four years.

Health suitability.—The one great contra-indicant to Ether is Bronchitis and a Catarrhal condition in and about the Bronchial and Laryngeal regions; Emphysema, if at all marked, is also a bar to Gas and Ether. A very gross habit of body, the resultant of alcohol and sloth, associated with nasal insufficiency and chronic thickening of structures of the neck and throat, is not an agreeable type for this sequence; such cases, however, have to be judged of individually. The danger here is not so much immediate as remote; this, on the whole, is not a type that comes before us frequently in nose and throat work. Much more common is the large class suffering from nasal stenosis, complete or partial, with concomitant symptoms of hypertrophied pharyngeal wall

and post-nasal catarrh. Here there is already present exaggerated secretion from the mucous membranes involved, which secretion will, of necessity, be increased and added to by ether. Without going so far as to say that gas and ether is inadmissible in these cases, I am distinctly of opinion, that when breathing is carried on largely through the mouth alone, it is wiser to induce and maintain narcosis by the aid of other agents, notably with the C.E. mixture, followed, if needs be, by Chloroform. The gain to the operator is marked; he is able to work in much greater comfort, freed from the constant recurrence of glairy mucus and ensanguined salivary secretions. The difficulty of maintaining an adequate degree of insensibility under these circumstances, is often an acute one, if we rely on the Gas-Ether sequence, especially, if, as sometimes happens, operative measures are at all prolonged. It should be borne in mind, that the nasal passages are frequently blocked behind, by enlarged ends of the lower turbinal bones, quite apart and dissociated from, any anterior obstruction at all.

The administration.—The gas-bag fitted with Hewitt's stop-cock must be filled, detached from the cylinder and fixed to a Clover ready charged with Ether. A suitable face-piece is selected and fitted on. No mouth prop will as a rule be required, though in certain cases when difficulty is anticipated, it will be advisable to have one in position or near at hand, in case of need. The patient's **head must be turned away from the middle line to one or other side;** this precaution will help to keep the base of the tongue from falling back, and so closing the tracheal opening. With the head correctly poised, *i.e.*, in the same plane as the trunk, and resting on a hard sandbag, we may begin the anæsthesia,

standing as before behind the patient. Air breathing through the valves of the stop-cock, for two or three full respirations, will allow the patient to settle down quietly without discomfort, the Ether indicator meanwhile remaining at O, and the expiratory valve being full open. Gas is then turned on by **closing the inspiratory valve,** the one movement shutting off the air-intake, and opening the inlet to the gas-bag. When the bag has been half emptied, the expiratory valve is put out of action, and at the same time the Ether indicator is set in motion, and **gradually rotated.** Breathing in and out of the bag now begins. As we proceed to rotate the indicator still more, the supply of Ether is naturally increased, but the symptoms induced will partake more of the Nitrous Oxide type than of etherisation. The face will grow dusky, and if the mask be kept, as it should be, firmly and closely fixed to the face, cyanosis of greater or less degree will supervene. Whenever possible **no air should be admitted for at least one and a half minutes.** At the end of this period one breath should be given, by quickly opening and shutting the inspiratory valve. The Ether indicator will probably now be at 2. From this point onwards we must arrange for a supply of air through the valve every **three or four respirations,** until at the end of two or two and a half minutes, we replace the gas-bag with a small Ether or so-called supplementary bag. At the moment of effecting the change, there is a liberal intake of air through the central aperture in Clover, so that, as a rule, there will be a sharp return of good colour. Our future procedure must be guided to a large extent by the depth of narcosis aimed at. Under all circumstances Ether must be continued still for some little time, as the necessary manipulations with the bags will have

permitted a partial return to consciousness. We therefore keep the indicator moving between 1 and 2 or 3 as the case may be. Cough must be met with **less ether** for a few seconds, until tolerance has been well established.

FIG. 4.

AUTHOR'S VALVED ANGLE-MOUNT.

Patience and tact are required at this stage. **Too much Ether** will produce faucial irritation and cough, with resulting congestion and engorgement of the soft tissues, and inevitable delay. **Too little Ether** on the other hand will allow of conscious movements with lively reflexes, and an absolute undoing of all the good hitherto achieved under Nitrous Oxide. The great points are to exclude an undue allowance of air, to watch very carefully all the signs which guide us —pupils—respirations—conjunctival reflexes, etc.,—to maintain **a good colour** free from duskiness, and finally to push home any opportunity of bringing about full narcosis, without saturating the patient with Ether. By using a movable slot in the angle mount of the Ether bag, it is an easy matter to regulate to a nicety the supply of air, without moving the face-piece from its fixed position. When the classic signs of full etherisation are present—fixed pupil with mid-dilatation

or full, abolished conjunctival reflex, noisy automatic respirations with blowing out of cheeks—the patient is ready for operation. In general, a Gas-Ether sequence as described, will give unaided, an available operative period of **about three minutes.**

The next step is to gag the mouth. For this purpose a Doyen or a Ferguson gag may be selected; the former occupies more space in the mouth, and many surgeons in consequence object to it. An assistant often holds the gag, but the anæsthetist from his special point of vantage, is easily able to control it if needed. The same rules of conduct which guided us in rendering aid described in a previous section, must again be observed here. Our duties, however, will be obviously increased in many directions.

Armed with a Junker and mouth-tube, we must be prepared to **maintain narcosis with chloroform,** if signs of returning consciousness manifest themselves. Slight leg movements towards the finish need not concern us much, but any attempt at spasmodic head movements, must be met with chloroform. To what extent this should be pushed, will depend largely on the degree of movement, in other words on the amount of consciousness present. If we have allowed the patient to come round too far, it will be no easy matter, in the presence of much bleeding in strong subjects, to restore the *status quo ante.* If, on the contrary, we have taken "occasion by the hand" and watched the signals carefully, we will have anticipated events by pumping in Chloroform vapour **in small quantities intermittently.** No hard and fast rule can be laid down for the exhibition of chloroform in these cases. It is clearly necessary to **push Ether,** in order to obtain for a definite period moderately deep anæsthesia;

and this degree of insensibility ought to be maintained, not so much by a large and indiscriminate addition of Chloroform, but rather by a **small and carefully balanced dosage,** just sufficient to enable the work to be smoothly accomplished.

The attention of the anæsthetist during the period of operation, has of course to be **primarily directed towards the well-being and safety of the patient,** and in procedures of moderate dimensions, both as regards time and quality of work done, he may find very little to do beyond steadying the head, and seeing that the airway is kept free and unembarrassed. When, however, the operation is prolonged, the case is far otherwise. Many surgeons elect to do all their nose and throat work in the Dorsal position—hence prolonged anæsthesia may be needed for almost everything that comes within the range of this definition. Be it always remembered that the anæsthetist's duties are twofold: *(a)* as guardian of the patient; (2) as assistant to the operator. As **assistant** we may review some of his duties.

Sponging.—In short operations—removal of tonsils and adenoids, etc., etc.—sponging may usually be dispensed with if the narcosis be limited to three or four minutes, and the head be kept well to the side after operation. Cough reflex of course soon returns and towards the end of an operation will begin to be so vigorous, as to obviate all danger of blood being aspirated into the trachea. Indiscriminate swabbing out of the throat, bruises the soft tissues considerably, especially when holders used are straight, and, as is so often the case, cumbersome in shape and faulty in construction. The curved holder shown in the woodcut, represents a simple form which seems to meet most require-

ments; the metal ends are small and well buried in the contained sponge, so that practically there is no danger of contact anywhere with the tender mucous membrane.

FIG. 5.

AUTHOR'S SPONGE-HOLDER.

The proper way to mop out the throat is to make a complete semicircle **from the gag** straight backwards and out at the opposite side, the object being to clear the way of blood obstructing the operator's view. Occasionally a rapid succession of sponging on these lines will be required—hence the need of an ample supply in reserve. The stump of a severed tonsil will now and then bleed freely; sponges wrung out in very hot water, and held hard against the bleeding surface, will usually prevail.

When the **Antrum of Highmore is opened through the canine fossa,** much foul muco-purulent secretion is often set free, and it will be the duty of the anæsthetist, or of an assistant directed by him, to fix a sponge against **the corresponding cheek and gum** in order to soak up discharge, and so prevent it from passing into the back of the mouth. Sponges fitted to holders will do admirably for this purpose. As they become sodden, they must be replaced by others, and held during the operation. The surgeon will see that they do not impede his action in any way, by changing the position as needs be from time to time.

One practical point in regard to sponges generally may be mentioned here. When once fitted to the holders they should on **no account be unshipped again.** As they become saturated they must be passed to assistants, whose care it will be to rinse and squeeze them out *in situ*, and return them for future service. If holders are not used, an ample supply of fairly large sponges is placed within easy reach, and the anæsthetist picks one up when required, in the blades of an adenoid or vulsellum forceps, quickly discards when soiled and just as quickly seizes a fresh sponge for his next attack.

Cyanosis.—This is very often an early symptom in anæsthesia, from **mechanical obstruction.** The airway is blocked either from spasmodic closure of the jaws, or from swelling of the soft tissues of the throat, notably the tongue. If recognised at once and instantly corrected by opening the mouth and pushing forward the lower jaw by pressure on the angles—a simple procedure which usually suffices—the equilibrium is quickly restored. Late Cyanosis may be caused by the presence of a foreign body in the trachea, *e.g.*, dislodged tooth or severed tonsil—or by aspiration of shed blood into the larynx when cough reflex has been abolished by deep narcosis. The **idiosyncrasy of an insensitive larynx,** fairly common in certain groups, must be guarded against by maintaining a light anæsthesia, approximating more and more as we proceed to the analgesic state, in order to avoid the dangers that may arise under these circumstances. **Cyanosis**, from whatever cause produced, **must be dealt with fully before proceeding with the operation** For this purpose the tongue forceps must be applied and a sponge passed far back and down so as to excite reflex cough. This will usually suffice; if it does not, direct stimulation must

be tried, by passing a finger into the larynx and between the cords. This will rarely fail, more especially if, at the same time, the diaphragm be forcibly compressed to aid in the effort at expulsion. In some cases artificial respiration must be promptly resorted to. All these measures of relief can be easily carried out at one and the same time, and must be persisted in until the breathing has been fully relieved. Naturally, the anæsthetist will not be single-handed in a crisis of this character.

In this connection one point deserves special emphasis. **Every effort of the anæsthetist should be directed to a clearance of the obstructed air-way,** and *post hoc*, to a re-establishment of normal respiration. While it may be necessary from motives of public policy or for other reasons to resort to strychnia, hypodermic ether, and heart stimulants generally, measures of this kind should invariably be left to others. The **one duty of the anæsthetist is with the lungs and air passages.** Profound cardiac enfeeblement, secondary to asphyxia, will need heroic stimulation, but primarily we must relieve the lungs; by so doing we shall indirectly, at least, apply the strongest possible stimulus to the heart and circulation.

Directions as to Pulse, Pupil, and Respiration.

In a long sequence blood loss may be considerable, and therefore a careful watch must be kept on the **pulse** and **breathing.** With practice, the temporal artery offers a ready means of testing the former, or in spare subjects the facial artery, where it crosses the lower jaw at the anterior

border of the masseter muscle. As a rule, if due regard be had throughout to the maintenance of an equable anæsthesia free from overdosage, and free from asphyxial troubles, there will be little need for anxiety as to the safety of the patient. The pupil must be inspected from time to time and any differences noted.* It is well to keep one pupil entirely in reserve; constant fingering of the conjunctiva may even in an analgesic state induce such tolerance, that we may be at times, relying on this alone, led into error. An appeal to the untouched pupil will probably reveal the truth.

The **respirations must always be seen and heard.**—For this purpose we must watch the chest walls, and note the movements, or, if in doubt, apply the ear to the mouth and both hear and feel the breathing.

Directions as to Vomiting and Attempted Vomiting.

If the patient has been well prepared on the lines already laid down, vomiting will usually not occur. It is always a sign of **light narcosis** and as such should be carefully, if firmly, dealt with. The absence of solid ingesta removes one factor of danger, and hence we invariably endeavour to prevent vomiting in these cases, by **pushing the anæsthetic.** We must remember, of course, that if threatened vomiting occurs during etherisation, there is much less risk in increasing the dosage. Should we fail to check the vomiting, it is best to allow the stomach contents to be freely voided, and then to return quickly to the anæsthetic, first clearing

* With full ether narcosis the pupil will be in a condition of mid-dilatation between 2½ and 3 m.m.s.

out the mouth and pharnyx, when full narcosis will, as a rule, rapidly follow. A persistent small pupil, with irregular spasmodic breathing, and unabolished conjunctival reflex, portends stomach movements which, unchecked, go on to complete reverse peristalsis. When this latter symptom appears, we know that we are on the eve of a *denouement*. Even at this stage we may often save the situation, but if once the stomach contents reach the pharynx in any bulk, nothing can arrest the process, and we shall then do well to let nature take its course. The **pulse** at the wrist shares in the temporary general disturbance, and is often **very irregular** and rapid as the crisis approaches.

Threatened vomiting at the chloroform stage of the Gas-Ether sequence, is difficult to control with the mouth tube alone, and, if we determine to stop it, we may have to apply the face mask for a time, charged with C. E. or Chloroform. When this is done, special care must be taken to **avoid too great an in-take**, during the period of deep free breathing which always follow emesis.

Directions for Gags, Mouth Props, etc.

In placing gags in position, care must be taken to avoid bruising the lips and gums. It is not unusual, if forcible efforts be made to gag the mouth, to find subsequently that some damage has been done to the soft tissues. If full muscle relaxation be not present, or there is still difficulty in separating the jaws, a wedge either of boxwood or metal may be inserted between the teeth, and used as a lever

to obtain space enough for the blades of a gag.* These latter should be covered at their extremities with rubber tubing, so as to minimise the pressure on the teeth to which they are opposed. Some gags are easier to manipulate than others. An Ackland for instance, with one blade in line behind the

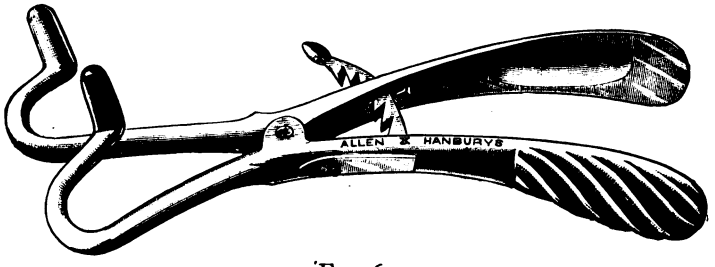

FIG. 6.

ACKLAND'S GAG.

other, is readily introduced through a very narrow chink, and will for this reason be found serviceable as a temporary prop, and for that matter, a permanent one too, if we so decide. For long cases, nothing will answer better than a strong well curved Doyen with chloroform tube welded on. This arrangement allows attachment of a rubber tube, connected with Junker's bottle, by which we may directly pump chloroform vapour into the mouth. Unfortunately for intra-oral manipulative measures this gag takes up too much space, and is not in favour with many surgeons. A good Fergusson fits the teeth easily and can be well controlled by the anæsthetist; it does not, more-

* My colleague Mr. Ernest B. Waggett makes use of a very simple device, well known, I believe, to throat surgeons, for opening clenched jaws. He passes a probe, through any available chink in the line of teeth, as far back as the pharynx. The patient responds at once to the stimulus by opening the mouth freely.

over, occupy much room, and being simple in mechanism, can be quickly relaxed or extended as the case may be.

Gags fresh from the steriliser are sometimes given to the anæsthetist, without being cooled off. This obviously may lead to trouble, and cases are on record, where blistering of the cheeks has resulted from contact with the hot metal handles. The gag shown in the woodcut (Fig. 7) is also a very useful pattern, in that it gives ample working space to the operator, and can be fitted to the mouth in two separate positions, with handles below the chin or lying well out of reach on the cheek. For operations on the mastoid antrum this peculiar shape has been found of great service, as it is easy to open the mouth without moving the head or disturbing the patient in any way.

When it is desirable to have as little traction as possible on the cheeks and lips, Hewitt's metal props with chloroform tube attachments, are quite admirable for the purpose; they are made in various sizes and being placed far back in the mouth between the bicuspids or molars, preclude all dragging or distension of the soft tissues. It is the duty of the gag holder, whether he be the anæsthetist or another, to see (first) that the instrument is **correctly placed**; (secondly) that it is firmly held in position; and lastly, that it grips the opposing teeth by its **shaped extremities** and not by the bare blades behind. This is no uncommon result of inattention or incapacity, and frequently causes embarrassment and delay. A gag that has slipped must be **instantly replaced.** The rubber pads must be firmly secured before the gag is used; they often work loose from constant service, and have been known to escape into the mouth from this cause. Finally, caution must be exercised both in withdrawing and

in introducing the blades not to lacerate the gums or the hard palate, nor to **injure the teeth.**

The management of the curved tube in the mouth and the bellows, **with one hand** should be encouraged by the anæsthetist. It will set his right hand free. Learners find the manipulation difficult, but it is easily acquired by practice.

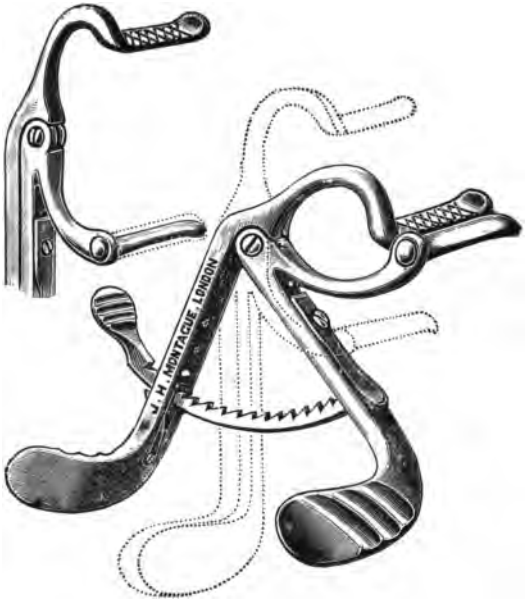

FIG. 7.

AUTHOR'S REVERSIBLE GAG.

Tubes are made either of lead or hard metal; the latter though rigid are on the whole to be preferred. If the surgeon's fingers are within the mouth and the space at disposal thereby curtailed, the tube must be withdrawn entirely or stowed hard up against the cheek; some amount of tact and ingenuity

will be required, in order not to interfere with any surgical procedure in progress.

These are the chief points calling for attention in regard to duties especially associated with the anæsthesia in the supine posture. The Gas-Ether-Chloroform sequence has been selected for fullest description as being the one best known, and probably most practised in this country. And the details given of difficulties to be met with, are those which experience has taught to be most common. Rules of conduct and special points in connection with this sequence in the supine posture, have been discussed with a view to making clear the troubles that may occur from mis-reading warning notes, and disregarding signs and symptoms as they arise. General surgical anæsthesia for ailments of the throat and nose, differs from the process as applied for other surgical conditions in this—that everything is centred, so to speak, in one spot—narcosis, operation, hæmorrhage etc.,—and that infinitely more labour is involved in cases of prolonged narcosis, in warding off difficulties and maintaining a calm and safe sequence, than is ever the case elsewhere. Practice will give confidence in these matters as in everything else, and things that may seem and really are difficult to the uninstructed, will weigh lightly with the well-trained administrator. Familiarity with him will breed, indeed, a greater sense of responsibility, but at the same time a strong feeling of security.

The C.E. Mixture.

The C.E. mixture in the proportion of two parts Chloroform and three parts Ether, is an admirable combination, and is growing in favour as an anæsthetic agent both for simple operations on the throat, and for inducing narcosis as a preliminary to Chloroform, in procedures of more protracted character. It has obvious advantages in many cases over Gas and Ether, in that the type of narcosis produced is free from venous engorgement, and free too from exaggerated mucus secretion. There is, as a direct consequence, less congestion of the soft tissues, and the mucous membranes, and greater freedom from cough—factors of much moment to the surgeon, and distinct advantages in delicate manipulations on the nasal cavities generally. The period of induction before full insensibility is reached, is naturally longer than in the Gas-Ether sequence, and there is often more resistance to begin with. We must proceed slowly and with caution, allowing a liberal supply of air, and keeping careful watch over the pulse and pupil as we proceed.

The C.E. mixture should always be given by the open method.—The mask shown here will be found excellent for this purpose. All danger of leakage on to the face and nose, is obviated by connecting the ribbed framework to the centre of the oval gutter, which constitutes the face piece proper. The addition of a fixed band running round the framework below, keeps the lint or gauze covering entirely away from the face; the bold inward sweep of the free edge of the

mask all round, is another safeguard in this direction. Constant annoyance is caused by blistering or burning of the nose and cheeks when a Schimmelbusch or other lint holder is used, as chloroform-laden moisture is deposited on the smooth surfaces of the supporting ribs, and carried along planes of least resistance directly on to the face.

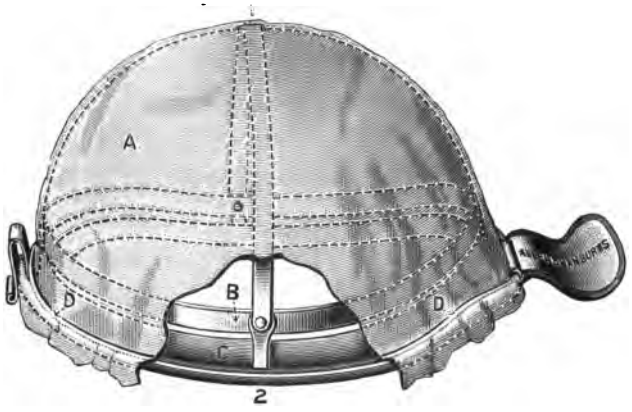

FIG. 8.

AUTHOR'S CHLOROFORM MASK READY FOR USE.

The cut edges should be shown *upturned*.

FIG. 9.

AUTHOR'S CHLOROFORM MASK (FOLDED).

Note encircling band and attachment of ribs to *middle* of the gutter, instead of to *inner* or *face* surface.

The anæsthesia produced by C.E. is very satisfactory in the case of children and young adults of full habit, as it is free from all cyanotic symptoms. The colour is heightened and there is usually some flushing at the end, but recovery is good and, as a rule, unattended with much after sickness. In giving C.E. a drop bottle should be used, and only **small quantities sprinkled on from time to time,** as evaporation takes place. During induction, unattended with resistance, the respirations are quiet and shallow at first, deepening as insensibility increases. The pupil of full narcosis is larger than the chloroform pupil but smaller than that of ether. C.E. has largely supplanted A.C.E. in general favour during the last decade; we know that the alcohol in the latter mixture is **practically inert,** and is, to a great extent, an undesirable addition. After excitement is common and recovery in consequence delayed.

Should there be **much struggling** during the induction period, the C.E. mixture must be **sparingly exhibited** for fear of **overdosage,** and the mask lightly applied to the face. The same cautious attitude should be observed with rapid spasmodic breathing, as in sobbing, especially in children; there is risk of dangerously increased intake in these circumstances. C.E. should always be **freshly mixed** just before operation. An old mixture loses some of its strength by evaporation, and cannot be wholly trusted. No attempt should be made to hurry on the narcosis, but it will often be advisable when nasal breathing is negative, to insert a mouth prop or a gag between the teeth, so as to allow of free respiration.

Ethyl-Chloride Anæsthesia.

During the last two or three years Ethyl Chloride has come very much to the fore, as an agent for inducing narcosis in throat work. It may be given alone or as a preliminary to Ether, and in the supine or the upright position. It has many advantages, chief among them being rapidity of action, production of marked muscle relaxation, depth of narcosis, and complete freedom from venous stasis—and some drawbacks, notably a tendency to post-operative sickness, and as we now know, to asphyxial crises which have in some cases ended fatally. With these facts before us, and the uncertainty as to how dangers arise, it is difficult to speak with absolute confidence of the future of ethyl chloride. The **respiratory centre** is apparently profoundly affected, and the heart only in a minor degree, if at all. It has been urged against this drug, that as cough reflex is entirely abolished for an appreciable period of time, it should be withheld in throat operations, but experience has not borne out this objection. The available anæsthetic period is usually about eighty seconds; this gives a good working margin, for many manipulative measures within the throat and nasal cavities. The **absence of congestion** in the tissues attacked, necessarily lessens blood loss, and by so much diminishes risks from clots impinging on, and being drawn into, the tracheal opening. Moreover, the actual cough reflex is not long absent, and can very quickly be restored by the simple stimulus of sponging out the pharynx, and at the same time turning the head laterally, so as to encourage ex-

pulsive efforts without delay. On this score, therefore, little or no anxiety need be felt. What we have to realise is this—that at present until further research has strengthened our hands, we must regard ethyl chloride as more dangerous than nitrous oxide, and only slightly less so than chloroform itself. Definite knowledge was wanting on this point until recent date, but now as the result of investigations at the instance of the Society of Anæsthetists, carefully recorded data have been received, which point clearly to the conclusion that however much we may appraise Chlorethyl as a narcotic agent, we cannot ignore the absolute evidence that has been brought against it. Doubtless trouble has arisen in certain cases from a culpable want of judgment in administering the drug. Seeing that respiration is primarily affected, it would clearly be wrong to exhibit ethyl chloride in subacute or even chronic lung affections, with concomitant extensive pleuritic adhesions. Selection must always be made with intelligence and forethought. Again, it should **never be given without due preparation of the patient,** and careful abstention from food for some hours beforehand. An empty stomach is the best precaution against sickness.

Mouth props or gags should invariably be inserted before anæsthetizing with Ethyl Chloride; masseteric spasm is not infrequently present, even though complete muscle relaxation may be pronounced in the limbs. Clenched jaws may readily prove difficult to open, and the beginning of much trouble and danger has often been traced to negligence in this direction.

As to apparatus for Chlorethyl administration, their name is legion. A good pattern is that in which Chlorethyl is poured into a small red rubber bag through a hole in the

angle mount, and the patient is directed to breathe deeply through a large face mask to and fro into the bag; in this way Ethyl Chloride vapour is rapidly absorbed and the desired degree of unconsciousness soon reached. The points to remember, whatever procedure be adopted, are these:

(a) Exclude the air after one primary inspiration.

(b) Keep the mask closely applied *ab initio*.

(c) Watch for classic signs of deepening narcosis—dilated pupils, slow pulse (at first), slight snoring respirations, general muscle flaccidity—insensitive conjunctivæ.

(d) Be watchful of **asphyxial symptoms.**

(e) Gag the mouth or insert prop between the teeth before beginning the anæsthesia.

(f) Push forward the head if in upright position, or turn laterally if in supine, as the **operation draws to a close,** in order to cope satisfactorily with hæmorrhage, and so to restore cough reflex.

(g) In cases of suspended breathing, **at once resort to artificial respiration** aided by upward pressure on the diaphragm.

(h) After operation, when possible, allow the patient to rest quietly lying down on the couch or chair. Early disturbance is one great cause of post-operative vomiting.

(i) Pay great regard to the **loosening of all garments** in situations where any constriction may take place.

(k) Do not give Ethyl Chloride at all **within four hours** of a solid meal.

Ethyl-Chloride-Ether Sequence.

For rapidity of induction this sequence is valuable, as insensibility, free from struggling and asphyxial symptoms, follows much more quickly, than with Gas and Ether. There is a plethora of apparatus to choose from, but for general use and efficiency, the fixture shown in the illustration, may be strongly commended. It is uncomplicated and handy, the Ethyl-Chloride container is under full control and the tap arrangement allows of fine gradations in supply.

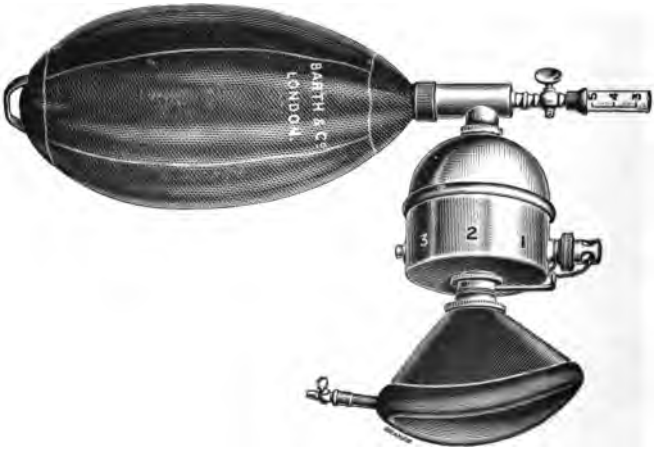

FIG. 10.

BAMFYLDE DANIELL'S ETHYL-CHLORIDE ETHER FIXTURE.

Bampfylde Daniell has used this apparatus in several hundred cases with uniform success, and speaks highly of his results, obtained as they have been, with carefully measured dosage, and a minimum expenditure of Chlorethyl. A thick glass tube carefully graduated in cubic centimetres,

is attached by red rubber tubing to the end of the tap on the angle mount. The charged Ether chamber is fixed, of course, between the angle mount and the face-piece, with indicator at O; Chloride of Ethyl is measured into the glass tube in the desired quantity 2, 3 or 5 cc.'s as the case may be. When the anæsthesia begins, Ethyl Chloride is allowed to fall gradually into the bag, being carefully regulated by the tap; in this way initial intolerance to the vapour is overcome and the supply added to, with increasing rapidity, as the narcosis deepens. Daniell reports that "a better induction results if the Ether be gradually turned on quite early, in fact a few seconds after the Ethyl Chloride has begun to be inhaled, so as to produce a mixture of the vapours."* The advantages of a container closed in this way by a tap, are manifold; accuracy of dose can be absolutely secured, waste is abolished, and only that amount of the drug given, which will produce the required result. In addition, by closing the tap when the tube is attached to the angle mount, the mask can be applied to the face without revealing the presence of Chlorethyl at all. This is a great gain in dealing with children and nervous patients generally.

* *Brit. Med. Jour.*, Ap. 23, 1904.

CHAPTER III.

Anæsthetic technique for Operations in the Upright Position.

This posture was first introduced by Dr. Edward Woakes, of the London Hospital, many years ago, and after passing through a prolonged period of trial and, in some instances, of vehement attack, has not only survived but is daily gaining in popularity. The cause for this is not far to seek. Without doubt the expansion of nasal specialism, and the demand for more active operative measures in many diseased conditions of the nasal cavities, has had much to do with the selection of a pose, eminently favourable to the surgeon, and, in skilled hands, not antagonistic to the safety of the patient. The great question at issue is this. Assuming that for surgical and anatomical reasons the upright posture is desirable, are we justified in urging its acceptance from the anæsthetic point of view? Were it possible to restrict the answer as to the use or non-use of Ether in this connection, it is probable that a unanimity of opinion would prevail in favour of such a procedure, but we well know that the solution involves far wider considerations. However useful Ether may be as an initial agent, it is clear that anæsthesia must be maintained throughout a long sequence, by Chloroform alone, and in this fact many surgeons, and not a few administrators, have found an objection of sufficient weight to encourage a policy of dissent. Hence, we find opinions more

or less divided, as to the danger of Chloroform in this position. Obviously, therefore, a question which has caused so much controversy, and given rise to such diversity of opinion, requires very careful inquiry and attention.

Until a very recent date, evidence bearing on the question of Chloroform poisoning was of a negative character, so much so indeed, that one great school based its teaching on the assumption, apparently, that rapidity of induction, **regardless of dosage**, was the one great thing to be aimed at. True, the open method was invariably adopted, and so it was claimed, an abundance of air supply ensured. To what extent fatalities followed on the adoption of this plan, we need not stop to consider. It is tolerably certain, however much we may be urged to believe the contrary, that danger and disaster frequently went hand in hand with ill-considered and illogical efforts of this kind. Thus, it came to pass that Chloroform, as a fundamental anæsthetic, fell under the ban, and for long years remained, in a measure, at least, neglected and unjustly feared. It was felt, and rightly so, that a drug possessed of such unknown and deadly potentiality should be, if possible, but sparingly used, and though many generations of men still clung fondly to it, no one knew with definite certainty, the manner of its malevolence, and the true physiology of its action on the heart. In the light of present knowledge, it says much for the skill of past administrators, (or the all wise supervision of Providence), that greater harm was not more often done. Well may the anæsthetist have said with Browning:—

> "I see my way as birds their trackless way—
> I shall arrive—what time, what circuit first
> I know not."

The position, then, of Chloroform was this, that whereas there was a general concurrence of opinion, favourable to the type of anæsthesia resulting from its use, men were loath to adopt it as a routine narcotic agent, through fear of its inherent uncertainty and danger. In this country, especially, but little headway was made, though truth to tell, Scottish surgeons stood firm in their support, and by their sturdy and exclusive allegiance, through good report and evil, helped in a marked degree to maintain the supremacy of their favourite anæsthetic. It cannot be doubted but that, for this solid loyalty, Chloroform would have long since been relegated to the limbo of things forgotten and contemned.

In time, the demands of modern surgery and the need for an anæsthetic status free from pronounced movement, and free too from general congestive disturbance, compelled practical physiologists to investigate anew the claims of Chloroform, and to discover, if possible, the causes of danger and the best means of combating them. The history of many inquiries bearing on these points, is too well known to need more than passing mention here. Suffice it to say that, though our knowledge was greatly added to, there yet remained many problems to be solved. Within the last decade, however, much evidence of the highest scientific value has been gathered, and we owe it chiefly to the researches of Embly and Martin that the **primal causes** of chloroform syncope, have been exhaustively investigated and explained. By a long series of experiments on animals, they proved unquestionably, that **primary inhibition of the vagus** is prone to follow the use of Chloroform, and that in proportion to the diminished excitability of the vagus present, so

too is the tendency to **shock diminished.** It is fair to argue by analogy, that what is true of selected animal types, is true also of man.

It was, moreover, clearly demonstrated by these observers, that a lessened percentage dosage of Chloroform vapour was required, in order to produce full unconsciousness; and that, inferentially, the 5 % limit hitherto accepted, was too high, and therefore a source of possible danger. One other point of great practical importance was revealed in these experiments, and that was the absolute necessity for inducing anæsthesia (Chloroform) **slowly, without hurry and with every regard to the establishment of tolerance in the initial stages.** It may be said at once, that the labours of Embly and Martin, have resulted in the elucidation of much that was hitherto but very imperfectly understood, in regard to chloroform narcosis. Here, at least, were definite scientific truths, evolved by definite scientific methods. The conclusions arrived at, seem well worthy of general acceptance, and, certainly, clinical observations based on the theories advanced and upheld by these observers, bear out to the full the contentions they were at such pains to establish. It cannot be said, of course, that complete unanimity of opinion exists, or ever will exist, even with data such as these to guide us. Men who still hold the view that the heart muscle is not unduly sensitive to the toxic effects of Chloroform, will refuse to be convinced by these records, but for the vast majority, they will prove of inestimable value in the safeguarding of patients submitted to Chloroform narcosis. The natural outcome, therefore, of these late researches is that we are placed in a most favourable position, as regards our knowledge of the factors that make

for danger, in the administration of Chloroform. As a direct consequence, we can now, with confidence administer it in many conditions where heretofore its use was, if not contra-indicated, at least generally discouraged. Hence, the *renaissance*, so to speak, of this drug, in the surgery of the nose and upper air passages.

It has been found possible to establish a narcotic condition in this connection, satisfactory alike to the operator and to the anæsthetist, induced with care and caution, and having always in view the great need of moving slowly, step by step, until complete tolerance has been established. Obviously, all procedures on these lines, should be conducted by well-trained men, equipped with special experience, keenly alive to the difficulties of the situation, and tolerably familiar with the surgical aims of the operator. The anæsthetist here, is like unto the pilot who has to thread his way through narrow channels, safe enough to one who has gone over the ground many a time and oft before, but anxious and exacting to the mere tyro.

This is eminently the class of case, therefore, that should not be attempted by anyone unacquainted with precise technique. The tendency nowadays, for all and sundry to try their prentice hands at anæsthesia, has frequently enough brought discredit upon the art. In simple matters failure, though regrettable and annoying, may not, after all, be of much import, but with graver issues at stake, the demand for skilled assistance, should be imperative and final. Given this, however, and it may confidently be affirmed that Chloroform *per se*, is not an unsafe narcotic for operations in the upright posture. To what extent, and in what way, it should be used, must depend of course largely on the physical con-

dition of the patient, and on the amount and character of the work to be done.

Selection, naturally, comes somewhat into play, to this extent at least, that no case, the subject of well marked cardiac trouble, would be submitted to operation in this position. The presence on the other hand of a slight functional disturbance, without physical signs of circulatory or lung embarrassment, would not of itself prove an objection to anæsthesia. As a matter of experience, suitable cases do well with Chloroform in almost any pose, provided always that we bear in mind, and put into practice, the cardinal rules that must always guide us in dealing with this agent.

In special regard, therefore, to Chloroform as applied to the upright posture, we may summarise our knowledge by the following practical conclusions:—

1.—To **overcome the initial tendency to vagal irritation,** and so to obviate all danger of cardiac inhibition. To this end, anæsthesia may be best induced by Gas alone, by Gas and Ether, by Ethyl Chloride and Ether, by Ether alone (an unpleasant alternative for the patient and therefore not to be generally commended), or by the C.E. combination.

2.—To be **exceedingly cautious as to overdosage.** This danger should not arise, if due care be taken to maintain an anæsthetic condition, deep enough to control undue movement, but not so deep as to abolish cough reflex. When once narcosis has been well established by any of the methods mentioned above, a small amount of chloroform vapour will, as a rule, suffice to maintain an even anæsthetic balance.

3.—To **avoid haste when dealing with Chloroform or the C.E. mixture ab initio.** It sometimes happens, that pre-

liminary measures with Gas or Ether, etc., have not been pushed sufficiently, and that the patient shows signs of returning consciousness, or at best, is but subconsciously affected. Then, if we elect to continue with Chloroform, we must proceed warily until tolerance is fully established.

Simple operative procedures in the Upright Posture, such as the removal of tonsils and post-nasal growths, can be readily dealt with under Gas alone or by the Gas-Ether sequence. To many operators Ethyl Chloride will appeal, and certainly the resulting narcosis is very favourable, the absence of congestion in the soft tissues being marked. Sickness, however, cannot always be prevented, and as we have already seen, there is more danger with Ethyl Chloride than with either Gas or Ether. For busy hospital work, where many cases have to be dealt with in a comparatively short time, Ethyl Chloride offers many advantages and is now largely used. The best apparatus for administering this drug alone, especially in this position, is that illustrated here. Within the angle-mount is fitted a metal tube which leads directly into the bag. Through this tube Ethyl-Chloride is sprayed in the desired amount; the opening is then closed by a metal ball attached to wire springs and the mask at once applied to the face. If it be decided to proceed **by gradual dosage throughout the induction,** the nozzle of the Chlorethyl vial may be inserted into the tube, and held in position, while pressure on the valve from time to time will release just that amount of fluid which the administrator needs at the moment. Little or no air will gain admission, if due care be taken to hold the vial steady and upright.

So much uncertainty exists as to the purity of commercial Ethyl-Chloride, that many practitioners still refuse to make

FIG. 11.

THE SIMPLEX INHALER FOR ETHYL-CHLORIDE.
(Duncan, Flockhart & Co.)

trial of the drug at all. It is most essential to have a guarantee of quality, and I would therefore strongly com-

mend to notice the British-made Chloryl Anæsthetic of Duncan, Flockhart & Co., a product entirely freed from impurities, and of uniform strength and reliability.

FIG. 12.

CHLORYL ANÆSTHETIC VIAL, FITTED WITH VALVE AND NOZZLE.

Gas-Ether Sequence.

In regard to the **Gas-Ether sequence for short operations sitting-up,** we must be prepared to deal with any period of insensibility ranging from one and a half to four minutes. Whether the operation be short or long, we must make systematic and adequate preparations for dealing with an anæsthetic condition differing, both in character and in degree, from the simpler state induced by gas alone. Thus, whereas N_2O even when pushed, never prolongs insensibility beyond forty seconds, and is followed by complete restoration of mental and physical functions, the sequence is always followed by a period of incomplete consciousness and mental torpor. Recovery in the one case is so rapid that it is hardly possible to imagine a difficulty arising, unless from some accidental and therefore unforeseen cause. Vigorous cough reflex easily disposes of blood and any detached fragments, and the fear of a severed tonsil entering the larynx is largely illusory, as the tongue invariably falls well back and effectually aids the epiglottis in guarding the tracheal opening. Guillotines sometimes come adrift and there is a real danger of screws and other small parts being lost in the mouth, but ordinary care will prevent trouble from a *contretemps* of this sort. Speaking generally, it may be said that to produce an available anæsthetic period of four minutes, we must bring the patient fully under the influence of Ether. For the first two minutes therefore after removal of the face-mask, careful observation must be kept and any emergency promptly coped with. As the influence of the narcotic begins to wane, the reflexes show signs of acute activity, and risks of the untoward occurring disappear.

For minor work, the *matériel* at hand can be utilised if no other be available. Thus, a couch with high firm back may well do for Gas or Ethyl-Chloride cases, any vacuum being filled in with pillows or cushions, so as to give adequate support for the head. In private, arrangements of this kind will be found to answer well. For Ether, either alone or

FIG. 13.

BAILEY'S SURGICAL TABLE AS ARRANGED FOR AN OPERATION IN THE UPRIGHT POSITION.

preceded by Gas, it will be wiser to adopt a firmer platform, as movements during the pre-anæsthetic stage are sometimes pronounced. An operating table with movable back, and a wide flap that can be raised, will serve admirably for the purpose. In this way a double inclined plane is produced which prevents the patient, once placed in position, from slipping. At my suggestion, Messrs. Bailey and Son,

Oxford Street, have arranged a back flap to their surgical table which moves through a much larger arc than usual, and allows the upright or semi-upright posture to be readily assumed when needed. Moreover, by a simple mechanical device at the side, the back flap can be instantly lowered into the full horizontal position. These points are well shown in the accompanying woodcut. Some device must always be adopted which will act *per se*, as no manual efforts will ever keep the patient *in situ*, without mechanical aid as indicated.

High Nasal Operations.

Operations on the Turbinate and the Ethmoid Bones, together with the prolonged manipulations sometimes involved in the removal of nasal polypi, resection of the septum, etc., etc., require special consideration. It must be remembered that in many of these cases, nasal breathing as such, is almost abolished, owing to blockage from mechanical obstruction or from long continued inflammatory or catarrhal conditions. We must therefore decide beforehand, whether the breathing is mainly oral, or if it is also largely shared in by the nostrils. Knowledge on this point will be valuable in the early stages of anæsthetic induction, as it will enable us to arrange for adequate absorption of the narcotic vapour by the known free channel.

For these operations, a **specially made chair** is strongly advisable. The annexed woodcut shows the pattern designed by Mr. Claud Woakes, and in general use at the London Throat Hospital. It is made of enamelled iron, and has a head rest that can be lowered or raised, to suit the height of the patient, and then fixed at the desired level. The head-rest is semicircular in shape, well padded in front,

and capable through a ball and socket joint, of considerable movement; in this way complete and perfect adjustment of the head is assured before the operation is begun. The turn of a handle fixes the head rest firmly in position. The forward portion of the seat is built up in the form of an abrupt rounded prominence, to receive the backs of the thighs, and

FIG. 14.

BAILEY'S SURGICAL CHAIR FOR OPERATIONS IN THE UPRIGHT POSITION.

so to steady the patient and keep him firm. A foot piece supports the lower extremities. By moving a lever on either side of the chair, the complete supine posture can be instantly secured. Attached to the back flap is a swinging rod, which strikes the floor at a right angle and supports the body when the flap is lowered. Messrs. Bailey and Son, the manufac-

turers of this chair, have made certain changes in the original design, which will considerably enhance its value in practice. The advantages of such a chair as this are, that the patient from the outset is under complete control from any point of view; the mechanism is simple and uncomplicated, easy to work and free in action; faulty positions can be quickly rectified, and any change in the decubitus, should such be deemed necessary, promptly effected with great ease and celerity. Moreover, the gain of having the patient seated in a chair that is compactly built and fitted well into the body, is very marked in those cases where excitement is prone to occur, followed by attempts at struggling and irregular movement. Restraint is easily applied without, as a rule, the exercise of undue force; it is distinctly easier to manage an unruly subject in the upright position than in any other. Should, however, the proper pose and head level be disarranged, it is a simple matter to put things straight again, before proceeding with the operation proper.

The special points calling for note in connection with operative procedures in the sitting-up position, are the following:—

1.—**The arrangement of the Head and Trunk.**

2.—**Choice of Anæsthetic.**

3.—**Degree of Anæsthesia to be maintained.**

4.—**Management of the Gag.**

5.—**Management of the Bleeding.**

6.—**Treatment of Impaired Respiration.**

7.—**Methods of Sponging.**

8.—**Duties of Assistants.**

9.—**Observations as to Length of Operation, Shock, and Blood Loss.**

10.—**Mechanical as opposed to Toxic Difficulties to be avoided.**

11.—**Immediate post-operative treatment of patient.**

12.—**After-effects. — Vomiting. — Anæsthetic Slumber.—Recovery.**

Arrangement of the Head and Trunk.

The patient is placed in the chair and firmly seated, with lower limbs flexed and supported by the leg rest. The transverse bar fixed to the leg rest is often removed; with an unruly patient it may readily form a strong *point d'appui.* In tall people, the head and neck will project well beyond the upper border of the chair back, and therefore the movable arm carrying the head rest, must be elevated sufficiently to fit the back of the neck, just below the occipital protuberance. This will give a pose of slight extension, but so slight as to cause no inconvenience in breathing. It is clearly important that an attitude in which the patient feels at ease, should be arranged; in practice, it will be found that the position indicated above will answer best. As regards the trunk proper, all wraps and coverings must be so disposed as to give free play to lungs and diaphragm. The neck especially must be loosely encircled, even at the risk of blood soakage, and any waist girdle, be it trouser band, belt, or corset, unfastened throughout. **No constriction of any kind can be allowed.** All these points must be seen to by the anæsthetist and rigidly enforced.

As a rule, every care is taken beforehand that patients conform to set regulations, but I have often found a tight bellyband overlooked in men and giving rise to much difficulty and embarrassment in breathing, until examination revealed the cause. The patient's arms rest lightly on the thighs or are held clasped in the lap. The practice of

gathering them together on the chest is wrong, because in this position more work is thrown on the cardiac muscle, and also because ready access cannot be had to the radial pulse, a matter of importance. Finally, locate the left hand and see that it can be easily reached; coverings are often so cunningly placed, that it will need some craft to disengage a forearm hurriedly.

Choice of Anæsthetic.

So much has been said in previous sections of the various methods of inducing narcosis, that no formal description of technique will be needed here. We have this however to bear in mind: with sitting-up cases presenting marked nasal obstructive symptoms, engorgement and increased secretion is very prone to follow prolonged etherisation, and so to create a situation full of annoyance to the surgeon, and of added labour to the administrator. On the whole, the less Ether the better. A beginning may be made with Gas and Ether in the usual way or, if desired, with Ethyl Chloride-Ether. The object of all preliminary measures is to prepare the patient for Chloroform, and this is often best done by substituting C.E. for the Gas-Ether Sequence quite early in the induction, before deep narcosis has been established by the latter.

A degree of anæsthesia which just falls short of abolishing conjunctival reflex will certainly admit with safety of a change from one narcotic to another. If, on the other hand, the anæsthetist be uncertain of his bearings, or more or less inexperienced in this work, he will be well advised to push

Ether to the physiological limit before removing the mask; then, as the effects slowly pass off, to control the situation with chloroform. **The ideal method to adopt in these cases is, in my view, N_2O to begin with, followed by the C.E. mixture given very slowly, and followed as tolerance is shown, and therefore at a variable period, by Chloroform sprayed on to a mask held lightly over the patient's face.** When the case is ready for operation, a mouth-tube replaces the mask, and the sequence proceeds in the usual way from a Junker's bottle. With care in administration, and **no attempt to hurry,** surprisingly good results are obtained by this method.

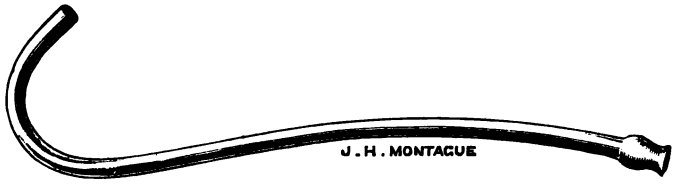

FIG. 15.

MOUTH-TUBE FOR USE WITH JUNKER'S APPARATUS.

As a rule, it will be unnecessary to wait until jactitation and much cyanosis has occurred before making the change from Gas to C.E. mixture. I have often effected this manœuvre in special cases, and so arranged the sequence, that all attempts at movement were well checked by preliminary Gas administration, and only partial recovery allowed to follow removal of the face mask, a condition which soon gave way under the careful exhibition of C.E. mixture or Chloroform. Especially is this plan to be commended in weakly adults, and those peculiar cases where horror of

insensibility in any form very readily brings about a condition of extreme nervous agitation.

In the opinion of many, **Ethyl-Chloride** forms the best initial narcotic in these cases. Its effects are rapid, there is no asphyxial factor, and the resulting insensibility is sufficiently long to ensure an even balance with partial recovery, when the chloroform administration is started. Nitrous Oxide Gas, however, deftly handled, is so reliable and so safe

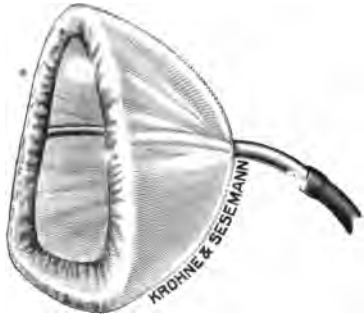

FIG. 16.

FLANNEL MASK ON FRAME FOR CHLOROFORM ADMINISTRATION.

an agent, that it seems to me to be specially marked out for selection in certain contingencies which I have endeavoured to emphasise.

Quite recently my friend, Dr. Barton, has brought to the notice of the profession, a method of inducing and maintaining narcosis with Ethyl Chloride which well merits attention. The liquid is contained in a metal cylinder and adequate evaporation is arranged for, by standing the cylinder in warm water; vapour is thus given

off in considerable volume throughout the sequence; a tap attached to the cylinder has fitted to it a length of rubber tubing which, by its distal end, is fastened to a metal tube leading into the mouth. This tube may be conveniently welded on to the mouth gag—as in Wingrave's dental prop —or held free in one hand. Sittings lasting for twenty minutes have been easily managed with this method. Full details are given in a pamphlet just published.

Degree of Anæsthesia to be Maintained.

To begin with, the patient must be so prepared that muscle relaxation is sufficiently pronounced to prevent any reflex movements. In other words, the anæsthesia must be fairly deep when the operator gets to work, and this for several reasons: the region to be attacked is very sensitive, and imperfect narcosis would naturally result in pronounced head movements, at the first touch of the knife or forceps. Moreover, the gag has to be accurately adjusted between the teeth, in the position best suited to the requirements of the surgeon. All this takes time and care, and some deliberation. It is wise, therefore, to have the patient well under at the outset, so that the anæsthetic may be intermitted during the active final preparations at the start. If this be done with well planned design, it is easy enough to allow of partial recovery as we proceed, at least to that point where slight cough reflex becomes established.

We may then formulate this axiom: **The state of cough reflex, moderate or full, as may be needed, must be estab-**

lished as soon as possible after the operation has been begun. When once the proper balance has been struck, it will usually be comparatively easy to regulate expulsive efforts, and keep them within moderate bounds. Our aim must be, as the operation advances, to maintain an equable light anæsthesia approximating to the analgesic type, **never to abolish cough reflex utterly,** and to restore it quickly should symptoms warn us that it is in danger of being lost.

Considerable experience, unquestionably, is needed, to secure this happy blend of moderate anæsthesia with retained cough reflex. It is the course between two extremes that will serve our purpose best—*in medio tutissimus ibis.* How, therefore, is this ideal to be reached? By care and close attention to minute detail. At times withholding the anæsthetic when everything is working smoothly, and then returning to it when, in our judgment, a further dosage seems necessary. With blood loss, inevitable in long operations, a minimum dosage will be indicated, and the intervals for its exhibition proportionately prolonged. Marked lid reflex may be present at this stage, without any other sign of conscious or subconscious effort, on the part of the patient. Routine is to be deprecated; each case will need consideration on its own merits. Thus for **alcoholics** and **strong, vigorous adults,** a policy of persistent aggression throughout may be needed; it may even be that the patient cannot be controlled by the mouth-tube alone—recourse must be had once and again, to a face mask charged with chloroform.

Every variety of temperament and of physical type, may be brought before us, and our attack must be arranged and

modified accordingly. Let two points, however, act as our guiding lights. By keeping them always in view, we shall steer clear of many shoals around. First, then, strive to maintain throughout, an **anæsthetic status of sufficient depth** to control and steady the patient, but no more; and secondly, **keep the cough reflex to the fore,** not strenuous and embarrassing, but in hand, so to speak, and ready to assert itself when expulsive efforts are called for.

We know of course from experience, how difficult it is in certain cases to avoid deepening the narcosis to meet a surgical crisis—the continued manipulation and separation of a large fragment, for instance, from the middle turbinate or ethmoid—and how easy the gradation is from vigorous action to loss of reflex, in these circumstances. Here, then, immediate measures of relief must be adopted to restore the *status quo ante.* An **insensitive larynx** cannot deal with hæmorrhage, and it is of the very essence of things, that this should meet with instant treatment. I have dealt elsewhere* with chloroform narcosis and the trouble that may come with toxic crises dependent solely on the action of the drug. The situation under review, and the danger arising therefrom if unrelieved, is largely and primarily mechanical, and therefore speedily adjustable.

In another section, I shall endeavour to give explicit details for dealing with bleeding, and the restoration of cough reflex, if, unfortunately, this should be in temporary abeyance during the progress of a high nasal operation. In regard to the anæsthetic proper in these cases, it will be obvious that the administrator, standing, as it were, *in loco superiore,*

* "Anæsthetic Difficulties," etc., etc.

has an exceptional outlook, and can give his undivided attention to the state of **pulse** and **breathing**, two factors of utmost concern and care. The slightest alteration in either will come at once, from his special vantage ground, under notice.

Management of the Gag.

This is a very important detail, and one that has to be settled before the operation proper begins. The **choice** rests to some extent with the surgeon—certainly in many intra-

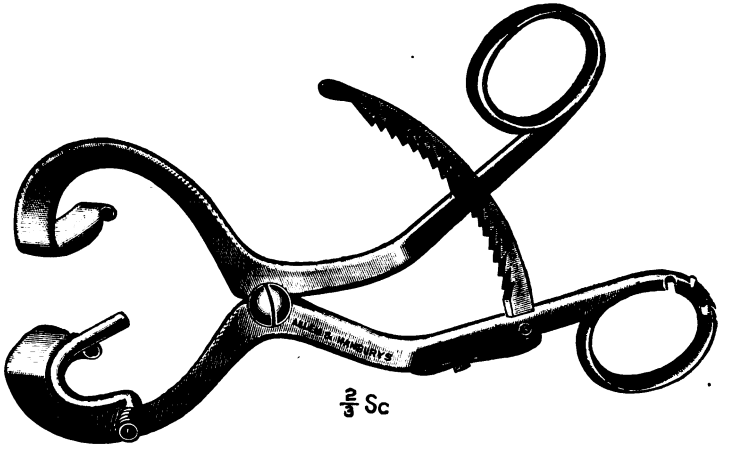

FIG. 17.

DOYEN'S GAG, WITH CHLOROFORM TUBE ATTACHED.
(PROBYN-WILLIAMS' MODIFICATION.)

oral conditions: he may elect to use a Ferguson, Doyen or some other pattern closely allied to these in shape, but differing perhaps slightly in catch or ratchet arrangement. A well made Doyen with attached chloroform tube, is excellent from the anæsthetist's standpoint. Once well placed, it

remains *in situ* without effort, and leaves the administrator with practically one hand free. Hewitt's Chloroform prop is also admirable in many cases. Fixed between opposing teeth far back, the soft tissues are not dragged upon, and anæsthesia is readily kept up by pumping chloroform vapour along the metal tube into the mouth, through a small opening in the prop itself. Nothing answers so well as this pattern, in radical operations on the Antrum through the canine fossa. It is made in various sizes. Should there be much jaw movement—as in subconscious and analgesic

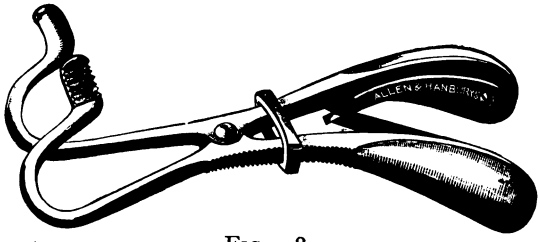

FIG. 18.

FERGUSON'S GAG, WITH THICK HANDLES.

states—there is a tendency for the gag to become dislodged; hence it is well (first) to select the largest size the patient can stand and, (second) to hold the metal tube *midway*, throughout the operation. Ferguson's gag is quite excellent in practice and much in vogue. It combines strength with great freedom of adjustment; the metal collar works with ease, and the handles are so made as to afford a firm and solid grip for the controlling hand. With a Ferguson in use, we must rely on the separate metal tube for conveying chloroform vapour into the mouth. This, I think, is preferable to the attached tubes as found in Hewitt's modification.

The **position of the gag in the mouth** is important. When fixed aright, *i.e.*, between opposing second bicuspids, the gag handles should lie close to the cheek, pointing **backwards and upwards** along a line directly bisecting the ear. Held firmly at this angle, the liability to side slip will be much diminished. As a general rule the gag will be fixed on the **left side**. In this position it can be readily controlled. Moreover, the anæsthetist can from this point slip a finger or two under the chin to keep the head level.

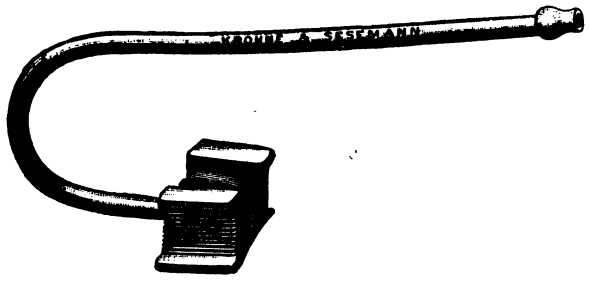

FIG. 19.

HEWITT'S CHLOROFORM PROP AND TUBE.

In **edentulates** it will be often no easy matter to prevent displacement of the gag; but the general rule as to position should be observed, and close inspection made, from time to time, to see that all is going well.

The anæsthetist must be alone responsible, in the vast majority of cases, for the position of the gag. He must, moreover, retain it throughout an operation. This is a wise rule, because training is needed for the task, and assistants who are unfamiliar with the technique, will often bring about trouble, if not an absolute *impasse*, possibly at a critical moment. Under all circumstances, the management of the gag is a serious duty requiring care and great attention.

Management of the Bleeding.

In many cases involving prolonged narcosis, there is often much hæmorrhage to be dealt with, and in people of full habit, blood loss may at times be considerable even in very short operations. Bleeding *per se*, is of a mixed character, and not calculated to induce a syncopal condition, at least in the early stage; but its very persistence, will help to embarrass the operator and the anæsthetist, unless means be taken to deal with it. On the one hand, the presence of vigorous cough reflex will result in constant expulsive efforts, the moment any fluid reaches the pharynx, and so delay the surgeon; while on the other hand, if cough reflex be extremely diminished, there is danger of blood and other secretions passing through into the trachea.

The question of **hæmorrhage** brings before us a consideration of other factors closely associated with it. Ether, for instance, induces very often profuse mucous secretion, and we have, as a constant factor in nasal cases, a thickened muco-purulent discharge. There is a tendency, therefore, to the formation of what may be called a **composite clot** in many nasal operations and this clearly contains many elements that might readily do harm, if absorbed into the system, in undue amount.

The anæsthetist will primarily attend to **intra-oral bleeding,** in a manner to be presently described. In this duty he may enlist help, should the case demand it, either from the surgeon himself or from an assistant.

The **intra-nasal treatment** of bleeding, by plugging and mopping out with wool swabs is carried out by the surgeon. The anæsthetist can assist, by cutting off the choanæ with a sponge carried up through the mouth and held behind the soft palate. He must be careful to note in attempting this manœuvre, that the **air-way should be left quite clear,** and also that bruising may be caused to the soft palate, if too much force be used with the sponge-holder.

Bleeding from an antrum operation is often met, by fixing a large sponge in the corresponding cheek, immediately beneath the incision. This is done, however, not so much to check hæmorrhage, as to collect foul discharge and blood, and so prevent them from passing back to the pharynx. An assistant will usually hold the sponge in position, replacing a sodden sponge with a fresh one when needed, but not infrequently this duty will fall to the anæsthetist.

Other details bearing on the subject of bleeding, will be dealt with in the next section.

Treatment of Impaired Respiration.

Throughout the sequence every effort is naturally made to keep respiration equable and regular, and by strict attention to rules already laid down and described, we may hope that nothing untoward will occur to disturb the desired equilibrium. It may be said at once that difficulties will arise, now and then, no matter how careful we may be in our conduct, or how skilled in administration.

Primary struggling, *i.e.*, during the induction period, may be followed by pronounced general muscular spasm, and a

condition but little different from opisthotonos itself. Until this state yields, there may be trouble with the breathing, unless the mouth is already gagged.

When these phenomena appear, we must take prompt action, prize open the mouth, and draw the tongue well forward. Pressure on the jaw angle at the same time will always help to clear the airway.

Faulty posture will easily bring about embarrassed respiration. Thus, the patient may slip down in the chair and with head sharply flexed the air supply is effectually cut off. Or again the head-rest may have been insecurely fastened and by gradually yielding have permitted of extreme extension. Obviously, errors of this class should be corrected as speedily as possible.

The chief and most important cause of embarrassed respiration in the upright posture, is partly toxic and partly mechanical. It arises from **the presence of fluid or blood-clot, either within the trachea proper or at the margin, at a moment when cough reflex is much diminished or in abeyance.** As an immediate consequence, the airway is partially obstructed, and the laryngeal muscles being in a state of momentary paralysis, cannot come into action. A large outflow will, occasionally, during fairly deep narcosis, bring about this crisis somewhat abruptly. Anyone at all familiar with rhinological anæsthesia, is always on the look out for signs and signals, and therefore *ab initio,* no matter how smoothly matters may be moving, **very close observation must be kept on the breathing.** Luckily, we have definite data to go upon—sure premonitions when danger threatens.

When fluid secretions or blood-clot are impinging upon, or

have actually entered the dangerous area, the **character of the respiratory sounds** undergoes a change. **Crepitations** large or small will accompany the **expiratory sounds.** If **fine crepitations** alone are heard, we may assume that the obstruction is largely **fluid.** If **large crepitations** or crackling are heard, the obstruction probably is largely **blood-clot.** This alteration in the quality of respiration, is a symptom to the anæsthetist of the **first importance,** and one which he should train himself carefully to observe and interpret at its true value.

Synchronously with the changed character of expiration, there is evidence of diminished ingress of air, and of a general deepening of narcosis. In practice, the onset of symptoms is met at once by prompt measures of relief. There is often felt a disinclination to intercept a surgical manœuvre, possibly at an interesting point, but clearly the interests of the patient must be seen to first, and no other consideration whatsoever should be allowed to outweigh this plain and pressing duty.

The **cough reflex must be restored as quickly as possible.** With head pushed well forward and held vertically the surgeon, or the anæsthetist, passes a sponge fixed to a curved holder, or gripped between the blades of a Lœwenburg forceps, low down in the pharynx and sweeps out blood-clots that may be collected there. This action repeated several times, stimulates the laryngeal muscles, and coughing more or less vigorous as the case may be, quickly ensues, and ends the crisis by causing rapid expulsion of any remaining intra-laryngeal obstruction. When the larynx is peculiarly or markedly insensitive and recovery is appreciably delayed, much good will result from forcibly **compressing the diaphragm.** This application of the *vis a tergo*

principle is extremely effectual in stubborn cases. Sometimes when other remedies hang fire, a **finger passed directly into the larynx** will act as a very brisk and rapid stimulant.

The operation proper must be suspended until free breathing and adequate cough reflex are once more restored.

Nothing, it may confidently be asserted, is more important in operative work in the upright posture than the avoidance of respiratory difficulty. When once the anæsthesia has been well established, pure toxic dangers, apart from overdosage, rarely occur. The great concern of the anæsthetist will be: to guard against obstruction of the air-way, to watch closely for approaching trouble, to deal with it promptly and firmly, and so to restore an even balance, and ensure a sequence free from undue anxiety or alarm.

A few words will suffice as to the duties of **assistants.** They will be needed, not so much for the service of the anæsthetist, as for general attendance during the operation, helpers in readjusting the patient should he have slipped out of place, washers of sponges and carriers of odds and ends required during the sequence. Now and then, the helping hand of a trained nurse will be grateful, either to steady the head, or to hold the gag in emergencies. Adequate support should always be at hand, even though it may be only held in reserve throughout. I have seen much discomfort caused by neglect of this precaution in difficult operations in strong subjects. Naturally, the anæsthetist has his own *matériel* within easy reach, but as he cannot leave his post even for a moment, he must have assistance at his instant command, should he need it.

Observations as to Length of Operation, Shock, and Blood Loss.

The indications for hastening the completion of an operation are: Facial pallor; small, thready wrist pulse; coldness of the face and extremities; increasing shallow breathing. With these signs *en evidence*, the surgeon must be warned that symptoms of **shock** are present, and cannot be disregarded. It is not usual to meet with this *ensemble* in ordinary cases, but weaklings and those well past the meridian of life, may often show plain manifestations of exhaustion, towards the end of a long sitting. Provided that at this point the patient be but lightly under the anæsthetic, and preferably in an analgesic or subconscious state, with fairly active lid reflex present, there is no cause for alarm. Nevertheless, the operation must be ended and the patient laid flat without undue delay.

In the absence of any other symptoms calling for special note, **coldness of the face and head**, must be taken as an indication of waning vitality. When this condition is noticed, and becomes pronounced, it is the duty of the anæsthetist to draw attention to it. Timely warning will enable the surgeon to complete his work, hurriedly indeed, but without panic or alarm.

As regards the **drug treatment** of shock, I have never, personally, had occasion to have recourse to it. Strychnia probably is not only useless, but even harmful, for as Lock-

hart Mummery* has shown, exhaustion of the nerve centres soon follows its administration; it is in fact but a fleeting stimulant and a false one at that. Our sole object in treating this condition must be to increase the peripheral resistance, and this is best done either by exhibiting Adrenalin **intravenously** or Aseptic Ergot **subcutaneously**. Both Adrenalin and Ergot act directly on the walls of the blood-vessels, and by causing vaso-constriction, raise the blood pressure and thereby "allow the heart and the vital nerve centres to renew their functions, very easily." Ergot Aseptic in sealed bulbs, each containing 1 cc. ready for instant use, is prepared by Parke Davis and Co., and has been very favourably spoken of. It is a product of uniform strength and purity.

In dealing with **collapse from severe hæmorrhage,** the proper treatment to adopt will be the intravenous infusion of normal saline solution. † The cause of trouble here is failure of the circulation through blood loss, and obviously we must replace the loss of fluid by a fresh supply intravenously. "It has been proved that serum alone and even physiological salt solution, is capable of taking up oxygen in the lungs and giving it off to the tissues, so that the circulation can be maintained, even though half the blood in the body has been replaced by physiological salt solution . . . "‡

Naturally, in any crisis calling for this treatment, the

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* Hunterian Lectures, "Lancet," April 1, 1905.

† Lockhart Mummery—*ibid.*

‡ Martindale's Tubes of Concentrated Salines are very useful for dilution to make two pints of Normal Salt solution. They also put up Ether and Brandy in ½ drachm Capsules ready for hypodermic medication.

proper posture for the patient will be the complete supine or, preferably, a modified Trendelenberg, with legs slightly raised and head lowered in the same plane.

Immediate Post-Operative Treatment of Patient.

The operation being ended, the patient must be lowered slowly into the complete supine posture, and then turned on his side without delay. The head had better be kept quite flat. Heavy people will be difficult to adjust properly, but this can always be done effectually, by bringing the supporting hip well on to the table, at such an angle that the patient will lie somewhat in the semi-prone posture. Where no device exists for lowering the chair, in other words, when the chair in use has a fixed back, arrangements must be made for removing the patient to bed as soon as possible. A soft pillow under the cheek will receive all drainage from the mouth. Bed coverings must be warm and closely applied all round, and a hot bottle should be ready at the foot of the bed.

As a rule **stimulation** either per rectum or hypodermically, will not be called for, but should it seem necessary, brandy or beef-tea may be administered in the usual way,

Resting quietly **on the side** as indicated, the patient will have a free air-way, and all discharge will flow forward into the pouch of the cheek, whence, as consciousness returns, it will be expelled by coughing.

The lateral decubitus, too, is a most favourable one for

vomiting—a contingency that must always be expected, in greater or less degree, in these operations.

Recovery to full consciousness is necessarily slow after severe operations, in much the same proportion that obtains in work of similar degree in other regions of the body.

Deep post-anæsthetic slumber is not uncommon, a condition from which the patient can be partially roused by vomiting, and which gradually gives place to drowsy wakefulness, as the effect of the narcosis passes off. The patient must be kept under close observation until his mental faculties are once more restored. With the advent of the rational state vigilance may be relaxed, and henceforward the case enters on another stage, beyond the purview of the anæsthetist.

FINIS.

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The Philosophy of Dickens—*contd.*

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